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ABSTRACT

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Improving Reading Comprehension: Embedding Diverse Learning Strategies Within A Mastery Learning Instructional Framework*

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Running Head; Learning Strategies and Reading

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Abstract

The paper describes the theoretical background, implementation and preliminary results of the Chicago Mastery Learning/Learning Strategies reading program for upper elementary students. Reading research and learning strategies research are pulled together to support the argument that the teaching of diverse learning strategies can improve reading comprehension and that the strategies should be embedded within the mastery learning framework. The purpose of this study was to develop and field test the materials so a controlled experiment was not conducted. Field-test results (involving 6 classrooms matched on 4 variables related to achievement) strongly suggest that teaching learning strategies improves reading comprehension.

Improving Reading Comprehension: Embedding Diverse Learning Strategies Within A Mastery Learning Instructional Format

Low reading comprehension is a critical and persistent problem in the Chicago school system. It affects all areas of educational and occupational attainment of Chicago youth. Until recently, attempts to remedy this problem have met with little success. Since 1975, however, the Chicago Board of Education has sponsored the development and testing of the Chicago Mastery Learning Reading project. This project aims to implement the powerful instructional model developed by Bloom (1968; Block, 1973) to improve reading comprehension for students in reading levels A-N (grades 1-8). Currently, mastery learning materials for levels F-J (grades 2-4) have been field tested and tested experimentally. The results of the experimental research provide strong evidence that mastery learning is a highly effective means of teaching reading for children in the primary grades of elementary school (Katims et al, 1977).

The project described here, the Chicago Mastery Learning/Learning Strategies project (CML/LS), seeks to improve reading comprehension for the intermediate and upper levels of elementary school. The CML/LS project is based on the assumption that low achieving students in the upper levels of elementary school have a special problem: they do not process what they read effectively and they have limited retrieval skills. Thus, these students are limited in their recall of specific information and concepts as well as their ability to utilize what they comprehend. Given this assumption, it is argued that teaching such students to use diverse learning strategies would improve their

reading comprehension.

Evidence for this argument derives from two areas of research: research on reading and research on learning strategies. Brown (1975) defines a learning strategy as any course of action that is deliberately instigated for the purpose of remembering. It will be shown that reading comprehension requires effective memory/recall skills which are greatly affected by the use of efficient learning strategies; that high recall student develop effective learning strategies spontaneously without explicit strategy training, whereas low recall students do not; and that reading comprehension can be improved by teaching low achieving students to use effective learning strategies spontaneously, i.e., that they will perform better on measures of reading ability without strategy instructions. It is also argued that since mastery learning has proved to be a successful instructional model, the most effective way to teach reading would be to imbed the learning strategy instructions within mastery learning units which are addressed to key reading objectives, as these are defined in the Curriculum Guide in Reading. Thus, when completed, the Chicago Mastery Learning/Learning Strategies units would extend the Chicago Mastery Learning Reading materials to the intermediate and upper reading levels: Levels K-N (grades 5-8).

Reading Research. The concept of reading used in this paper is the difference model defined by Cromer (1970). The difference model assumes that many reading problems result from a mismatch between the individual's mode of responding and the mode of responding required for the task. The evidence for this concept arises from a series of experiements (e.g., Cromer and Wiener, 1966) comparing good and poor readers in their ability to recall prose materials under different modes of presentation (e.g., in whole sentence, fragmented phrases, or one word at a time). The results consistently indicate

that poor comprehenders read word-by-word, that their recall of meaningful prose is limited compared to good comprehenders, and that presenting prose materials in small but meaning phrases facilitates comprehension.

Cromer's (1970) conceptualization of the problem suggests that differences in reading ability may be closely related to differences in learning strategies which enhance the meaningfulness of the information to be learned. Several lines of research support this assumption. First, studies of good and poor readers indicate that good readers use different learning strategies from poor readers. Weinstein and Rabinovitch (1971), for instance, found that good readers were more responsive to context clues than poor readers. One explanation for this finding is suggested by Allington (1978). He shows that good and poor readers are taught differently. In a study of the number of teacher interruptions and type of interactions during oral reading, he found that many teachers interrupt poor readers more frequently than good readers. More important, when good readers do not know a word, their teachers emphasize various contextual strategies which lead to understanding the meaning of the word from context cues. The same teachers force poor readers to guess at the word by sounding it out. (See also Brophy and Good, 1970).

Second, it is possible to improve comprehension by training students to use effective learning strategies. Levin et al (1973), for example, demonstrated that instructing children to construct mental images of what they read improves their comprehension. Similarly, Weinstein (1978) increased comprehension among high school and college students by training them to use effective imagery strategies. Organizational strategies, such as outlining, also aid comprehension as well as recall (e.g., Dansereau, 1978). And there is increasing evidence that contextual strategies facilitate

comprehension. Doctorow, Wittrock, and Marks (1978), for example, found that instructing sixth graders to generate sentences about story paragraphs during encoding aided recall and comprehension for high and low ability readers. Moreover, these instructions were more effective than instructing the students to read the story and one or two-word paragraph headings. Using a more complex contextual strategy, Rikards and Hatcher (1978) found that comprehension may be increased by requiring the reader to relate passage details to higher level ideas. Finally, Jones (1976) has shown that simple and complex imagery and organizational strategies are highly correlated to each other and to grade point averages.

Learning Strategies Research. What is the evidence supporting the idea that recall depends on strategy use? Numerous investigations provide strong evidence that imagery, categorizing, and various forms of outlining increase recall and that the use of these strategies is related to development. In general, young children are very limited in their strategy use and recall, compared to older children. At about age 12 there appears to be a developmental shift in strategy use so that by age 16-17, recall scores are close to those of college students. (See Flavell, 1970; Jones, 1976; Pressley, 1977; Rohwer, 1971b and 1973.)

Rohwer (1973) suggests that strategy use is a generalized propensity. According to him, children who use efficent imagery and elaboration strategies tend to use other efficient strategies; and obversely, children who use inefficient strategies on one task tend to use inefficient strategies on other tasks. Jones (1976), for example, administered tests for a range of strategies: imagery strategies, organizational strategies, critical thinking strategies, and reflective thinking strategies. Examination of the data revealed that the high achieving students (measured by grade point average) did indeed appear to

have a repertoire of interrelated learning strategies at their disposal while low achieving students did not. This research suggests that strategy use is not only a generalized propensity, but also that it is related to academic achievement.

Apparently this developmental shift in strategy use does not occur in all student populations. Rohwer (1973) found several instances in which low socio-economic status (SES) students were markedly lacking in the use of efficient learning strategies. These findings should not, however, be taken to mean that strategy use is necessarily a class-related phenomenon. Kennedy and Suzuki (in Rohwer, 1973) demonstrated that low SES, high ability students used efficient strategies on the task used by Rohwer. Also, Jones (1976) found a middle and upper SES population that was deficient in the use of diverse strategies. Equally important, she found that the schools of the low recall students in many of the studies purporting to test low SES students were below average in achievement (compared to the schools of high recall students). This means that the educational attributes (or cognitive pre-requisites) of the students have been confounded with their SES backgrounds in most studies. When all of these facts are considered, it seems likely that it is the achievement level of the students, not their SES background, that defines the parameters of population that do not make developmental shifts.

There is some evidence that low recall students can be taught to use efficient learning strategies when prompted to do so. Schultz et al (1973), for example, were able to train low recall students to attain the level of recall attained by high recall students the same age. (See also, Hall and Madsen, 1978; Jones, 1976; Rikards and Hatcher, 1978.) At the same time, there is only limited evidence that students can be trained to use efficient

learning strategies spontaneously without any prompting at the time of the test (e.g., Kennedy and Suzkuki, 1977; Jones and Hall, 1978; Cf., Hall, 1978).

Thus, from learning strategies research we know that recall depends on the use of appropriate learning strategies; that strategy use tends to be a generalized propensity such that individuals who use efficient strategies on one type of task generally use efficient strategies on other types of tasks; that there is a developmental shift in strategy use at about age 12; that not all populations make this shift; that those who do not make the shift are typically low achievers; and that low recall students can be taught to use efficient learning strategies.

Most of the studies cited above investigated the use of categorizing or imagery strategies in specific age and/or SES populations. What other strategies facilitate recall of meaningful prose? While there are many strategies that one could discuss, a review of learning strategies literature (Jones, Amiran, and Monsaas, in preparation) suggests that most of the more efficient strategies may be classified as one of two types of activity. On the other hand, there is the set of overt study skills which the learner uses to summarize and relate information: e.g., underlining (Rikards and August, 1975); paraphrasing (Kurth and Moseley, 1978); and outlining (Jones and Hall, 1978a; Friendly, 1977). On the other hand, there is a set of largely covert strategic behaviors or mathemagenic activities in which the learner engages to improve learning. Rothkopf (1971 and 1977) defines mathemagenic activity as any study activity that gives rise to learning. In fact, his recent research primarily involves studying the effects of inserting different types of "test-like questions" at different locations in the test (e.g., A small whale which is popularly called a porpoise is really the _____ dolphin.) Numerous experiments from his laboratory indicate that college students

spontaneously adapt their study behaviors according to the nature and location of the interspersed questions. Rothkopf hypothesizes that this happens because the students actively engage in studying the text as they read it.

The assumption that college students actively engage in diverse study behaviors or mathemagenic behaviors is supported by three other lines of research. First, Hall et al (1977), Frase (1977), and others such as Gagne and Rothkopf (1975) have established that test expectancy (recognition vs. recall) and the provision of learning goals which identify the purpose in reading influence recall. It is generally argued in such studies that test expectancy and goal descriptions are effective because the students spontaneously adapt their study behavior to learn different types of information. Second, asking students to generate questions while they read increase their recall of information (Frase and Schwartz, 1975). More recently, Wiener (1978) suggests that training students to generate questions may facilitate both learning and writing essays.

Third, Jenkins (1974) reviewed research for three learning tasks: free recall of words, recognition memory of events (stated in sentences), and recall requiring integration of information from different sentences. In each case he showed how the learner's comprehension of the context cues (cues regarding organization of the subject matter and type of task) radically affected what was remembered. His analysis emphasizes the importance of contextual strategies and suggests that learning strategy training by itself is not enough: it is important to train students to apply different strategies to different learning contexts.

Learning Strategies and Comprehension. Learning and recall are seldom discussed systematically in reading research and there are very few efforts to relate specific learning strategies to comprehension in learning strategies.

research. This paper has tried to show that the two strands of research parallel each other in concepts, assumptions, and empirical facts.

Clearly, the notion that reading ability consists of a system of interrelated cognitive processes is closely equivalent to the ideas that recall depends on a repertoire of learning strategies and that strategy use is a generalized propensity. Similarly it is assumed or implied in both strands of research (a) that skills develop in stages, (b) that differences in attainment (of recall or comprehension) can be accounted for largely in terms of differences in the development of efficient skills, and (c) that low attainment may be improved by training low achievers to use a set or system of effective skills. Empiricallly, recall and comprehension are integrally related: comprehension of how words and ideas are related increases recall; recall and comprehension are correlated; and the same strategies that increase recall, also increase comprehension. On the basis of this analysis, it was reasoned that students who are low in comprehension could be taught to use a repertoire of efficient learning strategies.

Given these propositions, the three sets of learning strategies known to increase recall and/or comprehension were selected to implement in the present research: (a) imagery strategies, (b) categorizing and cross-classification strategies, and (c) contextual strategies. Two other strategies were selected: (d) reflective thinking strategies (Auchenbach, 1975); (e) critical-thinking strategies. These two strategies were added because they are important skills which are highly correlated with grade point averages (Jones, 1976) and other measures of achievement (Auchenbach, 1970 a and b). See definitions below.

How should these strategies be implemented? The results of several lines of reseach were useful here. First, successful experimental efforts to

train low achieving students to use learning strategies spontaneously showed that typically many weeks or months of training must be allowed for the students to learn to apply the strategy to diverse items or problems. Second, according to Pressley (1977), aptitude by treatment interactions are task specific; i.e., imagery may be the most effective strategy for a particular aptitude group for one type of task but not necessarily the best strategy for a different task.

Third, the research of Bloom (1968), Ausubel (1970) and Lawton and Wanska (1977), indicates that cognitive entry behaviors and readiness are critical variables in learning. One way to implement this idea is to use advance organizers to relate the material to be presented to material that is known by the student. The problem here, however, is that without massive pretesting, there is no way to establish precisely what each learner knows. A solution to this problem is to use reading materials at the junior high level which would begin each set of materials with the assumption that the learner has no formal knowledge of the concept or skill to be taught. This means that each unit or set of related units should begin with very simple, concrete concepts and examples within the range of a student who has little formal schooling, (e.g., A unit of Analogies might begin with the classification of words for concrete objectives as same-meaning pairs or opposite-meaning pairs).

Fourth, compensatory reading programs have often been criticized (e.g., Jensen, 1969) because student achievement regresses when the compensatory program ceases; consequently many, if not most, of the gains are lost by the end of elementary school. A possible reason for this is that many compensatory programs cease in the middle elementary school years, just when the

high achieving students would be beginning to learn to use efficient strategies spontaneously. Another reason for this regression could be that there is a marked disparity between the objectives of the compensatory program and the achievement objectives of the regular school program. Thus, new programs should begin at or continue through junior high years and they should be consistent with approved curriculum objectives.

Fifth, research on mastery learning (Katims et al, 1977) suggests that the instructional model developed by Bloom (1968) is both practical and powerful for long term instruction. According to Katims, mastery learning is differentiated from traditional instruction by the regular and systematic use of formative evaluation and corrective instruction. Under this model students are tested for mastery of the objectives in each instructional unit. Individual deficiencies are identified by this procedure and students who have failed to reach mastery are given an additional opportunity to master the objectives of the unit and are prepared for the next unit. In addition, because the students have had some success in the course, they are better prepared affectively (i.e., more receptive, confident) as well as cognitvely.

In view of these considerations, it was decided that the present program would have the following characteristics:

1. It should begin at the point of the developmental shift (ages 11-12).
2. It should be conducted in the school as part of the school curriculum, so that there is little disparity between the curriculum objectives and the program objectives.
3. The program should emphasize a range of strategies for each task to accomodate students with different entry skills.

4. The strategies should be taught using a series of decreasing prompts or strategy instructions for each objective. Thus, by the time of the test for a given objective, the students should not have any strategy prompts.
5. The learning strategies should be embedded within the framework of a mastery learning instructional model.

The CML/LS Materials

The Learning Strategies. Five types of learning strategies are embedded in the mastery learning units.

1. Imagery Strategies - instructions to make mental pictures or drawings that represent what is read; e.g., in a unit on Analogies the students are instructed to visualize each word in the analogy.
2. Organizational Strategies - instructions to place information from narrative fiction and texts into two-dimensional tables, and instructions to analyze the information in rows and columns; e.g., in the unit on Mood they are instructed to use a two-dimensional table to analyze the body gestures given by the author for the eyes, mouth and voice, hands, and posture of each character in the story.
3. Contextual Strategies - instructions (by means of interspersed questions) to relate the meaning contained in one piece of information to other information in order to make inferences, determine the structure of a prose passage, apply rules, or solve problems; e.g., in a unit on Vocabulary, the students are instructed to "ask themselves" how the information from one sentence determines the meaning of an unfamiliar word in another sentence.
4. Critical Thinking Strategies - instructions regarding how to differentiate between various types of information and reasoning; e.g., instructions to be alert to words such as "should" that serve as cues for opinion statements.

5. Reflective Thinking Strategies - instructions to test out systematically each response choice in a multiple choice test situation, e.g., in the unit on Expanding Your Vocabulary, the learner is shown how to use what is known to eliminate incorrect answers and test out a hypothesis regarding the correct answer.

The Mastery Learning Units. All CML/LS materials are organized in terms of 20-28 page units that are addressed to key Comprehension, Study Skills, and Literature objectives which are defined by the Curriculum Guide as well as Vocabulary and Writing Objectives defined by the Learning Strategies staff. Each unit consists of 2-4 Student Activities, a Formative Test, a corrective Additional Activity for non-mastery students and in most cases an Enrichment Activity for mastery students. Each unit provides specific instructions to use the strategies that are necessary to attain mastery for any given objective. In addition, the strategies are also embedded in various fun activities (games, puzzles, discussion questions, or creative writing activities). Most units have 1-2 of these fun activities. Gradually the strategy instructions are withdrawn so that by the end of the last Student Activity, there are no strategy instructions.

1. Student Activities (SA). These are 2-4 pupil activities. Typically the first SA, which explains the objectives to be taught and the major strategy, is a Teacher-Directed Activity. This means that the teacher goes over the concepts and exercises very carefully with the class as a group. The remaining SAs are generally self-instructional, though any SA that the students find difficult can be converted into a Teacher-Directed Activity.
2. The Formative Test (FT). Each unit has a Formative Test which assesses the students' mastery of the skill or problem addressed in that unit

without any written strategy instructions. Most Formative Tests are keyed into the key reading objectives that are defined in the Curriculum Guide and tested for throughout the school system by means of Criterion-Referenced TEsts (CRTs). Each FT has a level of mastery that is approximately 80% of the problems. For units for which there is no CRT, there is a second Formative Test.

3. Additional Activities (AA). These are required for students who do not attain mastery on the FT. Each Additional Activity provides teaching/learning strategies that are different from those given before the FT.
4. Enrichment Activities (EA). These are self-instructional activities that seek to take the student to a higher level objective than that addressed by the FT. Whenever possible, these activities are games. It is hoped that this will provide motivation to attain mastery on the FT and to select this option.

Teaching Procedures

The Student Activities were devised to allow diverse teaching styles. It is possible, for example, simply to assign the units entirely on a self-instructional basis if the students are not behind in reading and are able to work independently. For students who are having difficulties, it is recommended that the teacher go over Student Activity #1 thoroughly in a "question/answer dialogue" with students. In a unit on Summarizing, for example, the teacher would ask one student to read aloud the definition of summarizing and the examples. Then the teacher might ask another student to paraphrase this definition. If the student had difficulty, the teacher would paraphrase and provide additional examples until feedback from

different students in the class indicated that the class as a group, understood the problem. This question/answer procedure applies to teaching basic concepts, instructions, and at least half of the exercise problems, so that the teacher is certain that all the students understand what is being taught in that activity. Thus SA #1 needs no correcting because the teacher and student have worked out the exercise problems together.

It is also very important to correct each subsequent SA before going on to the next one. This may be done entirely as teacher "homework:" i.e., the teacher marks incorrect answers and provides the correct answers. The preferred method is the question/answer procedure described above that was developed by our field-tested teachers; i.e., the teacher systematically asks individual students to provide the answer to each exercise problem. Following the responses, the teacher explains why the answers given are correct or incorrect. The students correct their mistakes by writing in the correct answer next to the incorrect answer using colored pencils (or even circling the correct answer). Thus, all that remains for the teacher to do is to record the number of correct answers for each activity.

After the students have completed and corrected all the SAs, they take the Formative Test. Those who do not attain mastery are required to do the corrective Additional Activity and the appropriate CRT or a second Formative Test if there is no CRT. Those who attain mastery on the first Formative Test have several options: (a) They may choose to do the Enrichment Activity. (b) They may engage in Sustained Quiet Un-Interrupted Reading Time (SQUIRT). (c) They may tutor those who are doing the AA. (d) Or they may do homework. Classroom observations indicate that providing these options is an important positive reinforcement for mastery students.

Teacher Input and Implementation

CML/LS materials were devised to be used with a minimum amount of inservice training (two one-hour sessions). This was possible largely because of the input we received from the teachers who field tested the materials. Members of the CML/LS staff visited each of the field-test teachers virtually every day in the morning before school and after each classroom observation. The teachers gave us feedback on such problems as typographical errors, incorrect grammar, format problems, vocabulary difficulties, ambiguous or incorrect answers in the answer keys, unclear instructions, insufficient explanations and exercise problems, and so on. More important, these teachers gave us invaluable suggestions regarding what type of additional activity was needed when the students were having difficulty with a particular unit. Many units were radically revised in structure and content on the basis of teacher comments. As a result of this feedback, two components were developed: the writing component and the answer keys for the instructional activities. We are also indebted to the field-test teachers for the system they developed to teach and correct our materials. The question/answer dialogue discussed above was a term we used to describe what we saw in the experimental classrooms. This method is now recommended in various places in the CML/LS Teacher's Manual.

Research and Development

The plan for research and development of CML/LS fits into the long-range plan of development, experimentation and implementation of mastery learning in Chicago. Mastery Learning Reading will extend from the primary level to the upper elementary level with the incorporation of learning strategies at the upper level. Parts of the mastery learning reading program are already

being implemented on a city-wide basis at the intermediate level. The purpose of the first year of CML/LS was to field test and revise the materials as they were being developed as well as to have a preliminary assessment of the effectiveness of learning strategies. The plan for the second year is to carry out a controlled experiment to determine the effectiveness of the program. The CML/LS materials would then be available to all Chicago schools by the 1979-80 school year, thus becoming the upper extension of the Chicago Mastery Learning Reading Program.

The CML/LS materials were developed and pilot tested simultaneously throughout the 1977-78 year. Typically, the procedure for pilot testing began with delivery of the materials to the pilot teachers for their review prior to classroom use. At least the first activity of each unit was observed by a member of the CML/LS staff, who observed both the teacher and the students to see what problems they might encounter in using the materials. For subsequent activities a CML/LS staff member visited each teacher to get feedback on the previous day's activity. We also analyzed students' errors on the Student Activities and Formative Tests.

Most of the problems were with the format and organization rather than with the substance of the materials or the selection and use of learning strategies. For example, a unit on the 5W's (Who, When, Where, What and Why) for students in level L (grade 6) was several pages longer than necessary because of a confusing format and instructions interspersed throughout the text that made it unclear as to exactly what the student should do. In response to this feedback, the unit was revised, reducing the number of pages by nearly half and setting off the instructions to the students from the spaces used in exercise problems. This organizational structure was then employed in subsequent units.

Because of the developmental nature of the program, a randomized study was not conducted. Nevertheless, data were gathered to compare our field-test classrooms with control classrooms in terms of their progress through the matrix of reading objectives and in terms of their gains in reading comprehension. Because of the quasi-experimental nature of the study, the results are necessarily only suggestive. The design selected for the research reported here was Campbell and Stanley's (1963) Non-equivalent Control Group Design. This design was used because the Chicago Public School population had diverse school and student characteristics and it was important to field test the materials in schools with different characteristics. Thus, the control schools and classrooms were chosen to match the experimental classrooms on several variables considered to be related to achievement (e.g., initial reading achievement and SES). Campbell and Stanley state that although results are equivocal using this design, "The more similar the experimental and the control groups are in their recruitment, and the more this similarity is confirmed on the pretest, the more effective this control becomes" (p. 49).

Campbell and Stanley (1963) list several factors that can jeopardize the internal and external validity of a study. Since the students were not assigned randomly to experimental and control classrooms, the populations to which the results can be generalized (i.e., the external validity) is limited. The design does, however, control for all but one of the threats to internal validity. Biases resulting from differential selection of students were controlled for by matching the groups on initial achievement in reading. Maturation of students, statistical regression towards the mean and loss of students (experimental morality) should affect the matched groups equally.

The use of objectively-scored tests already in use in the system controlled for the effect of changes in scoring methods (instrumentation), and pretesting effects. The factor that was not controlled for was history: events occurring between the first and second measurement in addition to the experimental treatment presents a possible threat to the internal validity. CML/LS staff members met with field test teachers frequently, a situation that would not occur under actual implementation. Because of the importance of feedback on the program itself, it was felt that controlling for this source of bias would seriously hamper the field testing of the materials.

To summarize, the design of this research limits the generalizability of the results, but does control for most of the threats of internal validity. Thus, it appears that positive results will strongly suggest the effectiveness of CML/LS in the classrooms studied. However, further research will be needed to determine the effectiveness of this program for other groups of students.

Sample Selection. Two schools were identified by a Chicago District Superintendent to pilot the CML/LS materials. The two schools were very different from each other. One was primarily a non-minority, lower middle SES school with a substantial percentage of students for whom English is a second language; the second school served students in a high-rise, minority housing project for low income families. Students in the latter school were about 3 years behind national norms on standardized reading tests with students in the former school being about 1 year behind national averages. Within each school, three classrooms of students were selected by the principal to participate in the pilot. In both schools, most of the classrooms with ages 11-13 students used CML/Ls materials. Therefore, it was

necessary to select matching classrooms at different schools to serve as controls.

A control school was selected to match each of the experimental schools on the following variables: (a) the number of years below grade level on the Reading Comprehension section of the Iowa Tests of Basic Skills (ITBS), (b) percent of families below poverty level (as a measure of SES), (c) major ethnic group, and (d) percentage of students for whom English is a second language. Within each control school, three classrooms were selected to match the three pilot classes on the basis of the range of ages and range of reading levels within the reading class. Specifically, locally developed reading levels were used to match control classes as closely as possible with the pilot classes. The control classes were using more traditional teaching methods and materials (e.g., various teacher-made materials and existing workbooks) but were also addressing the same Continuous Progress reading objectives as were CML/LS classes.

Criterion Variables. The major criterion variable in the evaluation of any reading program is reading comprehension. The Iowa Tests of Basic Skills (ITBS) is the major measure of reading comprehension and is, in fact, considered to be reading ability in Chicago (Katims, et. al., 1977). Further, schools were carefully matched on this measure and it is the only test for which pretest data are available. The second criterion variable was the Intermediate Level End-of-Cycle Test developed as a summative test to cover the key reading objectives for levels J, K and L. Because control classrooms were matched with CML/LS classrooms on the basis of reading level, control classes would have covered approximately the same number of objectives as the experimental classrooms. Nevertheless, it was expected that CML/LS students would perform better on this test.

The Results

Separate analyses were performed on the two criterion measures because they were designed to measure different things: the ITBS is a norm-referenced measure of reading achievement while the End-of-Cycle Test is a criterion-referenced test, which was designed to assess locally developed reading objectives. Tests comparing sample posttest means (Glass & Stanley, 1970) were conducted because the two groups (CML/LS vs. control) were matched initially on variables related to achievement.

Insert Table 1 about here

Results on the End-of-Cycle Test, a locally developed Criterion-referenced test, shown in Table 1 were highly significant ($p < .001$), with the CML/LS average being about 3 points higher than that of the control. Although there was no pretest to determine the initial equivalence of groups on this variable, the classes were matched by reading levels. Consequently, it would appear that teaching students to use learning strategies and providing them with corrective feedback in the form of mastery learning units helped them to master the objectives of the reading programs. These results were obtained despite two circumstances that were unfavorable towards CML/LS students. (a) The items on the End- of- Cycle Test were taken directly from the CRTs, giving the control students the advantage of already having taken parts of the test. Only non-mastery students in CML/LS classrooms took the CRTs while all control students should have taken the CRTs for their reading level--possibly several times in some cases. (b) The test is part of a new city-wide promotion policy in effect this year in Chicago. Because of this, some teachers were very anxious about their students' results on the test.

In fact, one control teacher was so concerned, that she spent two weeks preparing for the test; her students' results were considerably higher than those of other teachers in her school, making the results in Table 1 all the more striking.

Insert Tables 2 and 3 about here

More important in supporting the theoretical arguments made in the first part of the paper, are the reading comprehension scores. Inspection of the mean scores on the ITBS in Table 2 shows that CML/LS students did, in fact, have higher reading comprehension than non-CML/LS students. A *t* test of differences between the means shows the difference to be highly significant ($p < .005$). A *t* test comparing differences in average gain over the 1977-78 school year shown in Table 3 indicates that CML/LS students made significantly greater reading comprehension gains than control students. (Incidentally, a *t* test on pretest means showed no significant differences. Since the groups were matched on the ITBS pretest scores, this is to be expected.) Because of the quasi-experimental nature of the study, these results can only be considered suggestive. Nevertheless, they are certainly promising in that they indicate that the CML/LS may markedly improve reading comprehension.

Although no quantitative data were available, it is important to note that the informal feedback from teachers and students was highly favorable. The teachers felt that the learning strategies were very effective and that the highly structured nature of the materials provided them with considerably "more substance" to teach than traditional materials. The teachers also appreciated having the opportunity to provide correctives for the students who did not attain mastery on the Formative Test, while students who did

attain mastery could choose between enrichment activities and other options; apparently having this choice functioned as a reward for the mastery students. The students frequently commented that the materials were good because "they teach you how to think." Equally important, those who did not attain mastery at the time of the Formative Test, appreciated having the additional instructional materials and the second mastery test.

Conclusions and Implications

This paper has tried to provide a closely-reasoned theoretical framework for the idea that reading comprehension can be improved by teaching low achieving students to use various learning strategies. We have also tried to give a rationale for the major decisions that were necessary to implement this idea: namely, the selection of specific learning strategies, the selection of an instructional framework, and the selection of the appropriate ages. Evidence from the reading research strongly suggested that differences in comprehension related to differences in learning strategies. Studies of learning strategies showed that what is recalled depends on the use of efficient learning strategies, that low recall students do not make the developmental shift in strategy use that high recall students make, and that low recall students can be taught to use efficient learning strategies. Further, it was argued that the teaching of learning strategies should begin at the point of the developmental shift and that the strategies should be embedded in a mastery learning instructional format. Moreover, since there was only limited evidence that low recall students could be taught to use learning strategies spontaneously, it was decided to provide extensive strategy instructions in the beginning of each unit, and then gradually withdraw them.

The results reported here support the idea that students can be trained to use diverse learning strategies. In addition, the results suggest that

reading comprehension can be improved by providing the students with curriculum materials which combine learning strategies and mastery learning. However, cautious interpretation of these results is required because of the developmental nature of the study. Specifically, certain practical decisions limited the generalizability of the results. Moreover, the data reported here do not indicate whether the positive results could have been obtained without the mastery learning instructional model. Plans for 1978-79 include studies to confirm the results found in the pilot study. Particularly important are: (a) an evaluation of CML/LS with random assignment of classrooms to CML/LS and control conditions, (b) an experiment in which mastery learning alone is compared to learning strategies, and (c) several experiments which compare the effectiveness of different strategies. Although the field-test results can only be suggestive, the data presented in the preliminary evaluation reported here are consistent with the findings of previous research. Moreover, the favorable informal feedback from teachers and students indicate that CML/LS materials can be easily implemented with a minimum of inservice training.

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Table 1

Mean Reading Comprehension Scores for Treatment and Control Students Using a Criterion-Referenced Test

Group	N	M	SD	t score
Treatment	177	28.21	6.76	4.05*
Control	163	25.01	7.75	

Note. Maximum score = 40. The Chicago Public Schools, End-of-Cycle Test, Intermediate Level.

* $p < .001$, one-tailed.

Table 2

Mean Reading Comprehension Scores for Treatment and Control Students Using ITBS Standard Scores

Group	N	M	SD	t score
Treatment	158	254.17	16.01	3.09*
Control	141	248.20	18.07	

Note. ITBS = Iowa Test of Basic Skills, Reading Comprehension, Form 6.

$p < .005$, one-tailed.

Table 3

Mean Reading Comprehension Gain for Treatment and Control Students Using ITBS Standard Scores

Group	N	M	SD	t score
Treatment	145	3.05	8.46	1.65*
Control	119	1.35	8.27	

Note. ITBS = Iowa Test of Basic Skills, Reading Comprehension, Form 6.

$p < .05$, one-tailed.